LABORATORY OUTLINES FOR USE IN AN INTRODUCTORY COURSE IN SOMATOLOGY

By FRANK RUSSELL

At Harvard University two classes of students take courses in Somatology: those who are preparing for the profession of medicine and those who are fitting for professional work in Anthropology. The choice of the former is sanctioned by Topinard in these words: "The knowledge of Anthropology adds to medicine a certain superiority, it adds interest to the study of anatomy and physiology; it is the crown of the school of life." The other class acquire knowledge that is essential, in my opinion, to the anthropologist, whatever special division of the science he may enter.

These outlines are published in the hope that they may prove useful to students of Somatology who have not had, heretofore, such a guide. The prominence given to osteology is due in part to the limitations of a recently established laboratory and in part to the abundance of such material at hand. It is to be understood that other sections of the science of Somatology are presented in this general introductory course by means of lectures illustrated by charts, etc.

OSTEOLOGY

A.—Racial and Sexual Type

Study the series of Caucasian and Amerindian bones to determine the average size and form for each of the two races. Compare with the skeletons of other races as far as possible.

Determine the mean for each SEX separately and compare one with another. If DISEASED BONES are found, study their condition: osteoporosis, exostosis, ostitis.

In the study of PAIRED BONES compare right with left.

THE APPENDICULAR SKELETON

a. CLAVICLE:

Measure its length[1]; identify the deltoid tubercle; trapezoid line; subclavian groove; rhomboid impression; conoid tubercle.

b. SCAPULA:

1. Length.
2. Length to base of spine.
3. Breadth.
4. Vertical diameter of glenoid fossa.
5. Transverse diameter of glenoid fossa.
6. Scapular index.
7. Infraspinous index.

Identify the acromion; coracoid process; supra-scapular notch; spine.

c. HUMERUS:

1. Maximum length.
2. Maximum diameter of head.
3. Antero-posterior diameter at deltoid eminence.
4. Transverse diameter at deltoid eminence.
5. Index of shaft at deltoid eminence.
6. Maximum transverse diameter of condyles.
7. Angle of shaft from vertical.
8. Angle of neck and shaft.
9. Angle of torsion. Compare with that of quadrupeds.
10. Relation to stature taken as 100.

Identify tuberosities; pectoral ridge; deltoid eminence; coronoid, radial, and olecranon fossæ; trochlea; capitellum; spiral groove; supratrochlear and entepicondylar foramina.

[1] Fractions less than .5 of a millimeter may be disregarded; when above .5 the next higher whole number should be written. Whenever the series of measurements is sufficiently large, determine the *mean magnitude* instead of the average.

d. RADIUS:

1. Length.
2. Circumference at middle of shaft.
3. Perimetral index.
4. Humero-radial index, radius × 100 ÷ humerus.
5. Relation to stature taken as 100.
6. Relation of radius plus humerus to stature taken as 100.

Identify the tuberosity; oblique lines; sigmoid cavity; styloid process; tubercle.

e. FEMUR:

1. Length.
2. Length to great trochanter.
3. Oblique length.
4. Oblique length to great trochanter.
5. Maximum diameter of head.
6. Length of neck and head.
7. Index of *branche oblique.*
8. Height of neck at middle.
9. Antero-posterior diameter of neck.
10. Index of neck.
11. Antero-posterior diameter at subtrochanteric region.
12. Transverse diameter.
13. Platymeric index.
14. Degree of curvature.
15. Antero-posterior diameter at middle of shaft.
16. Transverse diameter at middle of shaft.
17. Pilastric index.
18. Popliteal transverse diameter.
19. Diameter Mn.
20. Diameter Mp.
21. Popliteal index.
22. Transverse diameter of condyles.
23. Condylar index.
24. Antero-posterior diameter of external condyle.

25. Angle of neck and shaft.
26. Angle of shaft from the vertical.
27. Angular index.
28. Angle of torsion.
29. Relation to stature taken as 100.

Identify the bicipital fossa; great, small, and third trochanters; tubercles of the quadratus and of the femur; intertrochanteric, spiral, and pectineal lines; gluteal ridge; linea aspera; popliteal surface; supracondylar ridges; tuberosities; intercondylar notch. Study the lamellæ in a transverse longitudinal section; pilastered femur; fossa hypotrochanterica.

Effects of dampness.—Measure a femur with the greatest care, then soak it in water for eight days and measure again to determine the amount of increase in volume.

f. TIBIA:

1. Length.
2. Transverse diameter of condyles.
3. Curve of external condyle.
4. Antero-posterior diameter at middle of shaft.
5. Transverse diameter.
6. Index of shaft.
7. Minimum circumference of shaft.
8. Perimetral index.
9. Angle of torsion.
10. Tibio-femoral index, length of tibia $\times$ 100 $\div$ length of femur.
11. Intermembral index, length of humerus $+$ radius $\times$ 100 $\div$ the length of femur $+$ tibia.
12. Relation to stature taken as 100.
13. Relation of tibia plus femur to stature taken as 100.

Identify the spine; popliteal notch; tuberosities; tubercle; oblique line; crest; internal malleolus. Note the significance and racial distribution of the curved external condyle and astragalo-tibial articulation.

Euknemia,
Subplatycnemia,
Platycnemia,
Retroversion.

Determine the stature from each of the long bones by the mathematical method.

Compare the methods of Rollet, Manouvrier, Topinard, and Dwight.

g. PELVIS:[1]

1. Breadth.
2. Height, summit of ilium to most depending part of ischium.
3. Breadth-height index, height × 100 ÷ breadth.
4. Breadth between the anterior superior iliac spines.
5. Breadth between the posterior superior iliac spines.
6. Breadth between ischial tubera, outer borders.
7. Breadth between ischial spines, tips.
8. Maximum diameter of obturator foramen.
9. Vertical diameter of obturator foramen.
10. Transverse diameter of obturator foramen.
11. Obturator index, transverse diameter × 100 ÷ vertical diameter.
12. Subpubic angle.

Dimensions of true Pelvis

13. Transverse diameter, between the ilio-pectineal lines.
14. Conjugate diameter, promontory to body of os pubis near the symphysis.
15. Pelvic index, conjugate diameter × 100 ÷ transverse diameter.
16. Oblique diameter, right and left, sacro-iliac joint to ilio-pectineal line, internal to the pectineal eminence.

[1] These measurements are taken from the article by Sir William Turner, "Report on the Bones of the Human Skeleton," in the *Challenger Reports*, vol. XVI, part iv, p. 6.

17. Inferior sagittal diameter, from the middle of the anterior inferior border of the body of the fifth sacral vertebra and the lower border of the pubic symphysis.
18. Coccygeo-pubic diameter, tip of coccyx to lower border of symphysis.
19. Intertuberal diameter, inner borders below sciatic notch.
20. Depth of pubic symphysis.
21. Depth of pelvic cavity, from brim near pectineal eminence to most depending portion of the tuber ischii.

Dimensions of Individual Bones

22. Height-length of ilium, angle at bottom of acetabulum to summit of crest.
23. Breadth of ilium, between superior spines: anterior and posterior.
24. Iliac index, breadth × 100 ÷ height-length.
25. Breadth of innominate bone, posterior superior iliac spine to pubic symphysis.
26. Length of os pubis, angle in acetabulum to the pubic symphysis.
27. Pubo-innominate index, pubic length × 100 ÷ innominate breadth.
28. Length of ischium, angle in acetabulum to most depending part of the tuber ischii.
29. Innominate index, breadth × 100 ÷ height-length.
30. Ischio-innominate index, ischial length × 100 ÷ pelvic height.
31. Length of coccyx.
32. Breadth of coccyx.

Define the limits of the ilium, sacrum, os pubis, and os acetabulum in the os innominatum; epiphyses; position of the pelvis in the course of ontogenetic development; true and false pelvis; spines; crests; foramina; notches; symphysis; tuberosity;

illio-pectineal line and eminence; angle of inclination; sexual dimorphism in different races.

Dolichopellic,

Platypellic.

Compare the shoulder girdle with the pelvic.

THE AXIAL SKELETON

h. VERTEBRAL COLUMN:

Study the changes due to the assumption of the erect attitude; anomalies in number of vertebræ; compare curves in child and adult; lumbar curve and index:

Kurtorachic,

Orthorachic,

Koilrachic,

Ensellure.

Determine the proportions of the cervical, thoracic, and lumbar regions.

i. SACRUM:

1. Length.
2. Breadth.
3. Index.

Study the normal form and note such anomalies as an open sacral canal; oblique sacrum; irregularities in the number of parts; number of coccygeal vertebræ; *vertebra fulcralis.*

Dolichohieric,

Brachyhieric.

j. THORAX:

1. Primary type.
2. Secondary type.

Determine the number of sternal ribs; sacral and lumbar vertebræ in the embryo; length of floating ribs; cervical ribs; bicipital ribs.

k. STERNUM:

1. Length of manubrîum.

2. Length of body.
3. Breadth at base of first sternebra.
4. Thickness.
5. Index, thickness × 100 ÷ breadth.
6. Relation of length to stature.

Test Hyrtl's law. Study the ensiform process; clavicular and interclavicular notches; fissura sterni; sternal foramen; ossa suprasternalia.

l. CRANIUM:

Make outline drawings of the front (norma frontalis) and side (norma lateralis) of a skull with Broca's stereograph and locate the following points:

asterion,
auriculare,
basion,
bregma,
dacryon,
glabella,
gnathion,
gonion,
inion,
jugale,
jugo-maxillary point
lambda,
metopion,
nasion,
obelion,
ophryon,
opisthion,
orbitale,
prosthion,
pterion,
stephanion.

Define the limits of the calvaria and calvarium.

Craniometrical planes: Arrange the skull for the above drawings with the alveolo-condylion plane horizontal; this plane is determined by the occipital condyles and prosthion:

Broca's horizontal or orbital, by the axes of the orbits;

Auriculo-infraorbital, by the auricularia and orbitalia.

Instruments: Measure the angles and projections with Ranke's goniometer or Verneau's cephalometer:

The arcs with a steel tape;

The larger diameters with Bertillon's calipers;

The smaller dimensions, except the optico-nasion length and the dimensions of the choanæ, with the sliding calipers.

Measurements

1. Capacity. Gage with water, Poll's method, or shot, Broca's method, or if the skull is too fragile use millet seed, or calculate the cubical capacity from the skull modulus (p. 43).
2. Glabello—occipital length.
3. Breadth.
4. Biasterial breadth.
5. Biauricular breadth, at superior margin of external auditory process.
6. Bistephanic breadth.
7. Interpterion breadth.
8. Minimum frontal breadth.
9. Bizygomatic breadth.
10. External biorbital breadth.
11. Internal biorbital breadth.
12. Bijugal breadth, between jugalia.
13. Bimaxillary breadth, maximum.
14. Bialveolar breadth.
15. Maxillary length, prosthyon to posterior extremity of arch; use thin strip of metal and measure in the middle line.

16. Basi-alveolar length.
17. Basi-nasal length.
18. Basi-bregmatic height.
19. Basion-obelion.
20. Basion-lambda.
21. Length of foramen magnum.
22. Breadth of foramen magnum.
23. Malar height.
24. Naso-alveolar height.
25. Spino-alveolar height.
26. Naso-mental height.
27. Orbital breadth, dacryon to maximum extent of largest diameter.
28. Orbital height.
29. Orbital depth, nasion to optic foramen.
30. Bidacryc breadth.
31. Nasal height, nasion to level in middle line of inferior margin of the nasal aperture.
32. Nasal breadth.
33. Palatal length, inner margin of arch anteriorly and exclusive of the palatal process.
34. Palatal breadth, between canines.
35. Palatal breadth, second molars.
36. Dental length, molars and premolars.
37. Height of choanæ.
38. Breadth of choanæ.

Arcs

39. Naso-malar, between outer margins of orbits over nasion.
40. Frontal, nasion to bregma.
41. Parietal, bregma to lambda.
42. Occipital, lambda to opisthion.
43. Total sagittal, nasion to opisthion.
44. Maximum transverse, anterior to external auditory meati.

45. Supraauricular, from superior border of the external auditory process.
46. Preauricular, over the glabella.
47. Total horizontal, over the glabella.

Indexes

48. Cranial, use the quinary nomenclature of the international agreement of 1886.
49. Vertical, height × 100 ÷ length.
50. Breadth-height, height × 100 ÷ breadth.
51. Stephano-zygomatic, bistephanic breadth × 100 ÷ bizygomatic breadth.
52. Upper facial, Kollman, nasion to prosthyon × 100 ÷ bizygomatic breadth.
53. Total facial, nasion to gnathion × 100 ÷ bizygomatic breadth.
54. Naso-malar, naso-malar arc × 100 ÷ internal biorbital breadth.
55. Orbital, height × 100 ÷ breadth.
56. Nasal.
57. Uranic, bialveolar breadth × 100 ÷ maxillary length.
58. Staphylinic, posterior breadth × 100 ÷ palatal length.
59. Dental, length of upper molars and premolars × 100 ÷ basi-nasal length.
60. Alveolar, basi-nasal length × 100 ÷ basi-alveolar length.

Relations of Arcs

61. Frontal—total sagittal, frontal × 100 ÷ total sagittal.
62. Parietal—total sagittal.
63. Occipital—total sagittal.
64. Preauricular—total horizontal.
65. Supraauricular—total transverse.

The Lower Jaw

66. Bicondylar breadth at middle of transverse axis.
67. Bigonial breadth.

68. Symphyseal height.
69. Molar height, vertical height at level of second molars.
70. Ramus height, vertical height of jaw.
71. Minimum ramus breadth.
72. Gonio-symphyseal chord, gonion to gnathion.
73. Condylo-coronoid chord, outer extremity of condyle to coronoid.
74. Bigonial arc, around anterior margin of the jaw.
75. Gonio-zygomatic index, bigonial breadth × 100 ÷ bizygomatic breadth.
76. Mandibular index, molar height × 100 ÷ symphyseal height.

MORPHOLOGICAL CHARACTERS OF THE CRANIUM

Normæ Cranii

a. NORMA FRONTALIS:

(1) *Form of the Face.*—Study the outlines of the face and determine if it is

Chamæprosopic or

Leptoprosopic.

(2) *Frontal Bone.*—Study the angle of inclination; the frontal eminences; the superciliary ridges; compare with those of the Neanderthal calvaria and with Melanesian crania; the glabella, age at which the frontal sinus appears; compare Caucasian with Mongolian; compare the internal angular process of the Caucasian frontal with that of the Veddahs; determine the percentage of occurrence of metopic sutures.

(3) *Nasal Bones and Nasal Opening.*—Study the angle at the median suture of the nasal bones; condition in the Caucasian child: Double inferior border, asymmetry, apertura pyraformis:

Macrolophic,

Microlophic,

Analophic,

Leptorhin,

Mesorhin,
Platyrhin.

(4) *Orbits.*—Observe the form: round, broad, square; direction of the principal axis, horizontal or inclined; roof obliquely inclined in Negroes; ontogenetic changes;
Prosopic,
Mesopic,
Platyopic,
Megaseme,
Mesoseme,
Microseme.

(5) *Superior Maxilla.*—Note racial differences in length; in depth of canine fossæ; history of the premaxilla; percentage of occurrence of infraorbital suture; changes resulting from the loss of teeth and absorption of the alveolar arch.

b. NORMA LATERALIS:

(1) *Facial Angle.*—Note the profile outline;
Orthognathous,
Mesognathous,
Prognathous.

(2) *Nasal Spine.*—Compare with Broca's scale; note racial difference in degree of prominence.

(3) *Profile of Jaws.*—Select six skulls to illustrate the changes taking place during the growth of the individual.

(4) *Malar Bone.*—Determine the racial differences in the degree of prominence; size of the marginal process; divided malar.

(5) *Arch of the Vertex.*—Note the type of arch; Neanderthal and Cro-Magnon types:
Scaphocephalic,
Platycephalic,
Tapeinocephalic,
Metriocephalic,
Akrocephalic.

(6) *Lineæ Temporales.*—Note position:

Feeble,
Moderate,
Well-marked.

(7) *Pterion.*—Note if the processus frontalis be present;

Pterion in K;
Pterion in H;
Epiteric bone;
Racial differences in the length of the spheno-parietal suture.

(8) *External Auditory Meatus.*—Study its form; percentage of occurrence of exostoses within.

(9) *Inion.*—Determine degree of prominence by comparison with Broca's scale.

c. NORMA VERTICALIS:

(1) *Outline.*—Regular, prominent, or flattened in any region:

Megacephalic,
Microcephalic,
Plagiocephalic,
Trigonocephalic,
Chamæocephalic,
Orthocephalic,
Hypsicephalic.
Parietal protuberances;
Sagittal crest;
Fronto-parietal bone.

(2) *Zygomatic Arches.*

Phænozygous.
Cryptozygous.

(3) *Senile Depressions.*—Note the changes in the parietals due to extreme age.

d. NORMA OCCIPITALIS:

(1) *Outline.*—Note if the outline of the transverse arch is pointed, medium, or flat.

(2) *Parietal Foramina.*—Note enlargement or absence.

(3) *Occipital Prominence.*—Observe the racial differences in uniformity of the occipital curve and in the subiniac region.

(4) *Supernumerary Bones.*—Study the morphological significance and percentage of occurrence of interparietal bones at the lambda:

Epactal;

Composite, Complete, Incomplete interparietal.

e. NORMA BASILARIS:

(1) *Foramen Magnum and Occipital Condyles.* — Determine the extent of normal variation; third occipital condyle; fusion with atlas; percentage of occurrence of the postcondylar foramina.

(2) *Paramastoid Process.*—Examine the collections for examples of this rare anomaly.

(3) *Alveolar Arch.*—Compare the types found with those of other races: U-shaped, parabolic, elliptical; torus palatinus.

Dolichouranic,

Mesuranic,

Brachyuranic,

Leptostaphylin,

Mesostaphylin,

Brachystaphylin.

(4) *Palatal Suture.*—Note racial and individual differences in this suture and in the posterior nasal spine.

(5) *Alveolar Hyperostosis.*—This anomaly will be found to occur much more frequently in some American groups than in others.

(6) *Teeth.*—Study the teeth in a series of skulls ranging in age from fetus to adult; their value as a criterion of age in skulls whose age is not known; phylogeny; supernumerary or undeveloped teeth; racial variation; tuberculation; rules for the identification of single teeth; direction of incisors; wear; pathological change: caries, abscess, exostosis, malformation.

(7) *Hyoid Bone.*—Make an outline sketch of the bone and

name the parts; percentage with united cornua; racial variation in the shape of the body.

Sutures

Note the percentage of occurrence of supernumerary sutures not before examined; degree of complexity, simple, moderate, or complicated; condition, open or closed, note whether inner table alone is synostosed; value of the condition of the sutures as a criterion of age; Gratiolet's classification of races; effect of premature synostosis upon the direction of development of the cranium.

Wormian Bones.—Note their number and position; use Broca's scale of size.

Interior of the Skull

(1) Study the sulci, pachionian depressions, meningeal grooves, digital impressions.

(2) *Aymará Fossa.*—Determine the percentage of occurrence; racial differences.

(3) Measure thickness of parietals; diploë; vitreous table. Pachycephalic.

Capacity

(1) Test the three methods of gaging (p. 36) with Ranke's bronze skull, taking the average of five trials and accepting no result that varies widely from the mean. Study Schmidt's corrections for the method with shot.

(2) Study racial and individual variation; compare with the capacity of prehistoric crania.

(3) Determine brain weight from cranial capacity by Manouvrier's, Schmidt's, and Welker's formulæ.

Variations in the relations of capacity and brain weight due to sex and age.

Moduli.—Test the various methods of determining capacity from principal measurements.

Cranial Criteria of Sex

Male.	*Female.*
1. Greater size, weight, capacity.	1. Smaller, lighter; varying in relation to the male skull in the different races.
2. Projecting glabella and superciliary arches.	2. Glabella small or wanting; superior margin of the orbits sharper.
3. Mastoid processes, inion, and crests for the attachment of muscles larger.	3. Mastoid processes smaller, inion and crests smaller or wanting.
4. Frontal sloping backward.	4. Frontal vertical with more pronounced frontal eminences.

Deformed Crania

1. *Pathological Deformation.*—Determine the cause; platybasic; synostosis; posthumous.

2. *Ethnic Deformation.*—Examine the collections for deformations due to head-dress: unconscious deformation.

3. *Artificial Deformation.*—(a) Occipital, (b) frontal, (c) fronto-occipital, (d) fronto-sincipito-parieto-occipital, (e) various.

Identify the *trepanned skulls* in the museum collection.

Statistics

Arrange a seriation table for each of the three measurements, length, breadth, and height, of the series of skulls measured.

Record maximum and minimum.

Extent of variation.

Theoretical mean of variation.

Compare the average, mean, and median values for the three measurements, length, breadth, and height, of crania.

Graphic Representation of Mathematical Terms:

Allen's "Terrace Method."

Method of loaded ordinates.

Bar diagrams.

B.—Human Compared with Simian Type

MATERIAL.—Identify the two species of anthropoid apes represented in the osteological collection and compare the several bones with those of the human skeleton.

a. *Clavicle:*

Length.

b. *Scapula:*

1. Length.
2. Length to base of spine.
3. Breadth.
4. Scapular index.
5. Infraspinous index.

Study also published tables and indexes; phylogeny of the coracoid.

c. *Humerus:*

1. Length.
2. Antero-posterior diameter at deltoid eminence.
3. Transverse diameter.
4. Index.
5. Angle of torsion.

Note the occurrence of the supratrochlear foramen.

d. *Radius:*

1. Length.

Compare the length with that of the humerus: of the arm exclusive of the hand, with the leg exclusive of the foot. Note the presence or absence of the os centrale. Size of thumb.

e. *Femur:*

1. Length.
2. Antero-posterior diameter at middle of shaft.
3. Transverse diameter.
4. Pilastric index.
5. Degree of curvature.
6. Angle of neck and shaft.
7. Angle of shaft from the vertical.

8. Angle of torsion.

f. *Tibia:*

1. Length.
2. Antero-posterior diameter at middle of shaft.
3. Transverse diameter.
4. Index of shaft.
5. Curve of external condyle.

Note the degree of retroversion.

Compare the length of phalanges with that of tarsus combined with metatarsus; the angle of inclination of the tarsus; divergence and small size of the great toe; two-jointed little toes.

g. *Pelvis:*

1. Breadth.
2. Height.
3. Index.
4. Transverse diameter of true pelvis.
5. Conjugate diameter.
6. Pelvic index.
7. Length of coccyx.

h. *Vertebral Column:*

Study the curves; the number of vertebræ in the several segments; total number of presacral vertebræ; long spinous processes of the cervical vertebræ.

i. *Sacrum:*

1. Length.
2. Breadth.
3. Index.

Note the number of vertebræ fused in the Anthropoid sacrum.

j. *Thorax:*

Determine the type; number of sternal ribs.

k. *Sternum:*

1. Length of body.
2. Breadth at base of first sternebra.

3. Thickness.
4. Index, thickness × 100 ÷ breadth.

l. *Cranium:*

1. Capacity.
2. Length.
3. Breadth.
4. Index.
5. Orbital breadth.
6. Orbital height.
7. Orbital index.
8. Nasal height
9. Nasal breadth.
10. Nasal index.
11. Cloquet's angle.

Compare the size of face with that of brain-case; superciliary ridges; low frontal; crests and ridges; position of foramen magnum; shape of palate; teeth, size of canines and third molars, diastema next the canines, number of tubercles on the molars, relative size of the teeth.

Note the extent to which synostosis has progressed, especially in the nasal and premaxillary bones; the transverse palatal suture; inferior border of the orbits as compared with the superior margin of the nasal opening:

Study the skull of the lemur, noting especially the teeth and the absence of the partition between the orbital and temporal fossæ.

ANTHROPOGRAPHY

I. PHOTOGRAPHY:

1. Take the full-length front view of the standing subject on the left third of the plate on a scale of $\frac{1}{21}$.

2. Expose the middle third of the plate for the right side, in exact profile.

3. Expose the remaining third of the plate for the back view.

4. Develop the negatives.

5. Make blue-prints from the negatives.

II. PLASTER CASTS:[1]

1. Make a two-piece mold of a *hand.*
2. Make a mold in three pieces of a *foot.*
3. Make a mold in one piece of a *face.*
4. Make a cast from each mold.

III. FINGER-PRINTS:

Take digital impressions of the right thumb, index, middle, and third fingers of the subjects studied.

IV. ANTHROPOMETRY:

The measurements to be taken upon the living subject are those recommended in the *Notes and Queries on Anthropology,* edited for the British Association for the Advancement of Science, third edition, p. 14.

Measure ten persons.

ESSENTIAL MEASUREMENTS

1. Head . . . . maximum length.
2. " " breadth.
3. Nose . . . . length from base to nasion.
4. " breadth across nostrils, without compressing them.
5. Projections of the head . . . . . from vertex to nasion.
6. " " " " " " mouth.
7. " " " " " " chin.
8. " " " " " " tragus of ear, the base of the projecting portion of the ear which guards the opening of the meatus.
9. Bizygomatic breadth.

9a. Length of face from nasion to under surface of chin.

10. Length of arm from head of humerus to end of middle finger.

11. Length of cubit from elbow to end of middle finger.

[1] Molds and casts must be made in the presence of the instructor.

12. Length of the hand along its back.
13. Length of foot.
14. Sitting height.
15. Kneeling height.
16. Standing height, the head held erect but not bent backward in an unnatural position.
17. Height to chin.
18. Height to sternal notch.
19. Height from internal malleolus to the ground.
20. Span of arms, shoulders horizontal.

ADDITIONAL MEASUREMENTS

21. Maximum breadth of shoulders.
22. Maximum breadth of hips.
23. Diameter of face, external biorbital breadth.
24. " " " " biocular breadth.
25. " " " internal biocular breadth.
26. " " " bigonial breadth.
27. Ear, maximum length.
28. " breadth from base of tragus to outer rim.
29. Height of umbilicus to the ground.
30. Biorbito-nasal arc.
31. Circumference of the chest, in repose, forced inspiration and forced expiration.
32. Minimum supra-malleolar circumference of leg.
33. Maximum supra-malleolar circumference of leg.

34. Tracing of hand.
35. Tracing of foot.

} { Mark the sub-styloid and sub-malleolar points and the extremities of the metacarpo- and metatarso-phalangeal joints.

SPECIAL MEASUREMENTS

(*a*) Length of body from seventh cervical spine to lower end of coccyx.

(*b*) biacromial breadth.

(*c*) biiliac crest breadth.

(*d*) Length of arm, acromion to humero-radial line.

(*e*) Length of forearm, humero-radial line to tip of styloid process.

(*f*) Length of thigh, antero-superior iliac spine to external femoro-tibial line.

(*g*) Length of leg, femoro-tibial line to end of *external* malleolus.

(*h*) Height of external malleolus from the ground.

V. DESCRIPTIVE CHARACTERS:

(*A*) After measuring the subjects describe them according to the schedule of characters on pages 12 and 14 of *Notes and Queries*.

(*B*) Determine the color of eyes with the aid of the Bertillon color chart.

(*C*) Examine the fold of skin at the inner angle of the eye as directed and explain the meaning of the terms: caruncula lacrymalis, epicanthus, plica semilunaris.

(*E*) Cut and mount upon a microscopic slide a cross-section of the hair of the head.